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SPECIAL ADVANCED STUDIES FOR POLLUTION PREVENTION

Delivery Order 0058: "The Monitor" – Winter 2000

Science Applications International Corporation
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STINFO FINAL REPORT

MATERIALS AND MANUFACTURING DIRECTORATE
AIR FORCE RESEARCH LABORATORY
AIR FORCE MATERIEL COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OH 45433-7750

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THIS TECHNICAL REPORT IS APPROVED FOR PUBLICATION.

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Volume 6, No. 3 - Public Release Number 1200 **Winter 2000**

EDWARDS AFB IMPLEMENTS ENVIRONMENTAL LOGISTICS TEST & EVALUATION INTO ACQUISITION DEVELOPMENT . . . see page 8

TABLE OF CONTENTS...

The MONITOR is a quarterly publication of the Headquarters Air Force Materiel Command (AFMC) Pollution Prevention Integrated Product Team (P2IPT) dedicated to integrating environment, safety, and health related issues across the entire life cycle of Air Force Weapon Systems. AFMC does not endorse the products featured in this magazine. The views and opinions expressed in this publication are not necessarily those of AFMC. All inquiries or submissions to the MONITOR may be addressed to the Program Manager, Mr. Cliff Turner.

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THE MONITOR ON INTERNET

This issue of the MONITOR is available on the Internet at the ASC site (http://www.ascenv.wpafb.af.mil/monitor.htm). The current issue of the MONITOR is in a Portable Document Format (PDF) file which requires a reader program for viewing or downloading. The Adobe Acrobat reader is available for downloading at no cost.

HQ AFMC/LG-EV RECOGNIZED AS A MODEL ENVIRONMENTAL LOGISTICS PROGRAM IN THE AIR FORCE

Headquarters Air Force Materiel Command, Logistics Environmental Office (HQ AFMC/LG-EV) has won the 1999 General Thomas D. White Pollution Prevention Acquisition Award. HQ AFMC/LG-EV has been recognized for establishing acquisition-sustainment partnerships that support the warfighter meet mission requirements better, faster, cheaper, and cleaner.

"Our mission spans from supporting the maintainer in the field to facilitating joint service solutions to common environmental problems across multiple weapon systems. This award recognizes the LG Environmental Team's efforts to support the Air Force in reducing life cycle costs through innovative strategies that encourage partnerships, reduce duplication, and maximize Air Force resources," states Ms. Debbie Meredith, HQ AFMC/LG-EV Branch Chief.

Established in 1996, HQ AFMC/LG-EV's primary mission focused on leading AFMC's Hazardous Materials Management, which includes the Pharmacy Program. "Our approach to Hazardous Materials Management at AFMC encourages the cradle to grave philosophy," says Diana Blake, HQ AFMC/LG-EV. "One of our bases, Robins AFB, has served as a model for the DOD effort on material/hazardous waste tracking." HQ AFMC/LG-EV is also the Air Force lead for managing Ozone Depleting Substances. The organization manages these materials across the Air Force to ensure an adequate supply is available for future mission requirements.

"What makes AFMC/LG-EV a model environmental logistics program is that while we in civil engineering focus on day-to-day compliance issues, LG-EV is mitigating future compliance problems by implementing source reduction solutions today. This results in tremendous cost savings that directly impacts the civil engineering business area at AFMC," states Steve Coyle, AFMC/CEVV Pollution Prevention Funds Manager.

In 1998, AFMC/LG-EV's traditional role in Materials Management was expanded to include hazardous materials reduction across the weapon system life cycle. HQ AFMC/LG-EV formed partnership through the Air Force and the Department of Defense to promote acquisition-sustainment linkages. Currently, HQ AFMC/LG-EV chairs the AFMC's Center Working Group that solves common pollution prevention problems across AFMC and the Air Force. "In support of the warfighter, our last working group meeting hosted at HQ ACC included presentations from Air Force Major Commands, weapon systems, and Air Force/DOD organizations that provide pollution prevention support to these communities," states Frank Berger, HQ AFMC/LG-EV.

HQ AFMC/LG-EV Team Wins Award

HQ AFMC/LG-EV is also the Air Force principal representative on the Joint Acquisition-Sustainment Pollution Prevention Activity (JASPPA). JASPPA is the working group of the Joint Group on Pollution Prevention (JG-PP). Since its inception in 1994, JG-PP activities have resulted in $37 million in cost savings and cost avoidance and $78 million in avoidance in duplication of effort. Currently JASPPA is implementing 13 projects that have a depot focus. "HQ AFMC/LG-EV provides support to JASPPA in various technical areas including plating, coatings, propulsion, and corrosion control," states Tom

Lorman, HQ AFMC/LG-EV. "Our high velocity oxygen fuel (HVOF) project will replace the need for chrome plating on landing gear for various weapon systems. HVOF implementation will save the AF and Navy Weapon Systems hundreds of thousands of dollars annually because the technology allows for longer field serviceability, quicker depot repair processes and fewer depot environmental and occupational health operational costs," states Warren Assink, HQ AFMC/LG-EV.

In 1999, HQ AFMC/LG-EV established a new team to identify future environmental requirements. "Although we are doing an excellent job of mitigating environmental cost and risk to the Air Force, HQ AFMC/LG-EV has now gone the next step to pro-actively identify future requirements. We will share our efforts in this area within the Air Force and DOD through the Center Working Group and JASPPA," states Ms. Debbie Meredith.

In conclusion, Ms. Meredith states, "I attribute our success in establishing a model environmental logistics program to a diverse and competent LG-EV team that comprises of 13 government and contract support personnel. We are not a typical environmental office. The members of the team have backgrounds in logistics, maintenance, operations, material engineering, industrial engineering, and environment. In additional to the in-house expertise, our success is due to the partnerships we have within the Air Force, the Department of Defense, and NASA."◆

PROPULSION PRODUCT GROUP WINS AIR FORCE MATERIEL COMMAND (AFMC) POLLUTION PREVENTION AWARD

The Propulsion Product Group Manager, Robert J. May Jr. and Ron McAtee, Propulsion Environmental Project Officer were presented with the 1999 Air Force Materiel Command (AFMC) Pollution Prevention Award by Maj. Gen. Paul Bielowicz, SA-ALC Commander (see photo). The Pollution Prevention Award was awarded to the Propulsion Product Group based on the efforts of the Propulsion Environmental Working Group (PEWG). The PEWG is chartered by the DOD Joint Propulsion Coordinating Committee (JPCC) to lead DOD/Industry collaboration to resolve environmental issues and introduce less hazardous materials and process technologies into gas turbine engine (GTE) overhaul and manufacturing operations.

"The award was a culmination of outstanding leadership of Ron McAtee, Frank Ivancic, and the distinct accomplishments of the Propulsion Environmental Working Group (PEWG)" states Robert J. May Jr., Single Manager. "The PEWG exceeded Air Force policy metric requirements by reducing Ozone Depleting Substance and AFMC-24 material usage by 98%."

"PEWG's success is primarily attributed to various partnerships the group has formed in executing projects," states Ron McAttee. "The PEWG, with 50 members from the worldwide propulsion industrial base, is one of the few DoD organizations addressing global environmental issues across both competitive and proprietary boundaries."

"The PEWG continuously promotes implementation of P2 principles and technologies throughout the Propulsion Industrial Base, " states Frank Ivancic, PEWG Program Manager. "We have initiated over 20 projects, leveraging Original Equipment Manufacturers experience, to implement less hazardous materials for parts cleaning operations at DOD depots. To further enhance the green engine concept, we are collaborating with various System Program Offices (SPOs) to incorporate environmental considerations into the acquisition decision making process."

Currently, the PEWG has teamed with the Joint Strike Fighter (JSF) engine IPT to introduce advanced coating technologies as replacement for chrome plating in manufacturing and rework processes. There is an on-going effort with the F-16 SPO to identify hazardous materials in Pratt & Whitney's GTEs. Additionally, PEWG is collaborating with the Air Force Research Laboratory, Fuels Branch (AFRL/PRSF) to identify the toxicological properties for JP8+100.

Additional information regarding ongoing PEWG projects and activities is available at the PEWG web site (http://www.pewg.com) and the related article on page 20.◆

(L-R) Maj. Gen. Paul Bielowicz, Robert J. May Jr., Ron McAtee

REGULATORY UPDATE: MISCELLANEOUS METAL PARTS & PRODUCTS (MMPP) RULE

The 1990 Clean Air Act requires that the Environmental Protection Agency (EPA) develop a number of regulations to restrict the emissions of various hazardous air pollutants (HAPs) from identified sources of those emissions. Those regulations go by the acronym "NESHAPs" - National Emissions Standard for Hazardous Air Pollutants.

Dozens of NESHAPs have been created since the early 1990s, including an Aerospace NESHAP that covers aircraft painting and metal finishing operations, and many more are being developed. One NESHAP of concern to the aerospace and defense sector is the Miscellaneous Metal Parts & Products (MMPP) NESHAP which will restrict HAPs due to the coatings, sealants, or adhesives used on metal products. EPA proposes for inclusion under this rule the following categories of industry: aerospace equipment (covering parts that are NOT addressed by the Aerospace NESHAP), automobile parts, extruded aluminum, heavy equipment, job shops, large trucks & buses, magnet wire, metal buildings, metal containers, metal pipe & foundries, rail transportation, recreational vehicles, rubber/metal parts & products, and structural steel. The MMPP would not apply in cases where the coatings of parts or products are already covered by another NESHAP.

The effort was initiated in 1998, when EPA sent out nearly 3000 questionnaires to industrial facilities to gather data for the MMPP. Most of the larger aerospace manufacturers and a number of Department of Defense (DoD) facilities received the EPA questionnaire. EPA has held

Continued on page 7

JOINT GROUP ON POLLUTION PREVENTION OVERVIEW ON NON-CHROMATE ALUMINUM PRETREATMENTS

The Joint Group on Pollution Prevention (JG-PP) is leading an Environmental Security Technology Certification Program (ESTCP) project to identify and qualify environmentally acceptable alternatives to chromate conversion coatings on aluminum alloys. This project will coordinate the non-chromate aluminum pretreatment demonstration and validation efforts of the Department of Defense (DoD) and industrial entities. Key output will be a Joint Test Protocol (JTP) that will guide the qualification of non-chromate pretreatments in this and future efforts. A revised specification will also be required to incorporate alternative pretreatments with existing, qualified chromate products.

Phase I of the project will include the nomination and down selection of alternatives and the development of the JTP. The down selection will be based upon many factors including toxicity, ease of application, amount of hazardous waste generated, technical performance, and supporting product information. Toxicity data such as LD50, LC50, and skin and ocular irritation will be reviewed for each alternative. An independent laboratory will conduct testing if toxicity data is found to be incomplete or deficient for a particular alternative. Table 1 details a list of nominated alternatives.

Nominated Alternatives
Alodine 5200/5700
Brent Chemcoat
Organosilane/CTC
Bi-K
X-it Prekote
Chemidize 727A
Trivalent Chromium
Cobamine

Table 1. Nominated Non-Chromate Alternatives

Phase II will focus on the field demonstration and validaton of alternatives. Processing characteristics will be evaluated for each product for transition to DoD and Original Equipment Manufacturer (OEM) facilities. To verify application protocol, product application will be conducted at one or more DoD facilities, not a vendor-supplied source. A waste profile will be developed for each alternative.

Technical performance will be evaluated by carrying out the testing procedures and evaluation criteria developed in the JTP. General validation criteria will likely include corrosion performance and paint adhesion largely based on existing specification and standards.

Finally, supporting product information will be evaluated for content concerning set-up, operation, and maintenance of the application process.

Long-term tracking, data acquisition, and analysis will be incorporated to determine the success of each process. The period of performance necessary to approve any alternative will be determined in Phase I of the project, but will likely require one to two years of in-service evaluation. In addition, non-chromate field repairs and touch-up applications will be demonstrated.

Detailed cost benefit analysis will be performed to evaluate the environmental and financial benefits of each alternative. A method similar to the Environmental Cost Analysis Methodology (ECAM) will be used. Data will be collected on baseline material use and costs considered for materials and energy, labor, and environmental, safety and health activities.

Proposed demonstration platforms and facilities are detailed in Table 2. Each performer will evaluate the results of testing based on the JTP and select alternative pretreatments to demonstrate on their high-value platforms and facilities. With successful results, full-scale testing on components and complete test platforms would ensue. Product training will accompany field testing so implementation by representative facilities can take place rapidly after product verification.

Performer	Proposed Platforms and Components	Proposed Demonstration Facilities
Army	➡ Bradley Fighting Vehicle ➡ Armored Amphibious Assault Vehicle ➡ Crusader	➡ Army Research Lab/Aberdeen ➡ Red River Army Depot
Air Force	➡ F-15 ➡ C-130 ➡ F-16	➡ Robins AFB ➡ Hill AFB ➡ Wright-Patterson AFB
NASA	➡ Shuttle External Tank ➡ Solid Rocket Boosters for Space Shuttle	➡ Kennedy Space Center
NAVAIR	➡ P-3 ➡ S-3 ➡ H-60 ➡ F-A/18	➡ Naval Aviation Depots at Cherry Point, Jacksonville, and North Island ➡ NAWCAD Patuxent River
Boeing	➡ Airframe Components	➡ Boeing St. Louis and Kent

Table 2. Proposed Demonstration Platforms and Facilities

For further information regarding this article, please contact Mr. Craig Matzdorf, NAWCAD, Patuxent River, at (301) 342-9372 or visit the JG-PP web site at http://www.jgpp.com.

Source: 4th Annual Joint Services, Pollution Prevention/Hazardous Waste Management Conference & Exhibition Proceedings, San Antonio, TX, Dec. 1999 ◆

JOINT GROUP ON POLLUTION PREVENTION: BOEING OVERVIEW BRIEFING ON ALTERNATIVES TO CHROMATE CONTAINING PRIMER COATINGS FOR AIRCRAFT EXTERIOR MOLD LINE SKINS

Chromate paint primer was selected for the Boeing Aircraft & Missile Systems Group (B-A&M)-St. Louis pilot by the DoD programs because it is a hazardous material with potential worker safety implications. This JG-PP project has evaluated laboratory performance and is currently evaluating operational performance suitability of nonchromate primer on multiple platforms and in a variety of service environments. In addition to overall performance of nonchromate primer, the project will also attempt to identify the correlation between laboratory tests and field performance.

The test requirements for qualification were defined in a Joint Test Protocol (JTP), developed by DoD program representatives from the C-17, F-15, F/A-18, T-45TS, Harpoon SLAM, AV-8B and B-A&M representatives. Testing requirements includes laboratory testing and over four years of operational testing on multiple platforms. Laboratory testing was completed in May 1997. Two of the test primers, PRC DeSoto EWAE118 and Dexter 10PW22-2, were selected for follow-on field testing that began in July 1997 and will continue through December 2001. Operational testing is providing side-by-side comparison of traditional Military Specification primers containing chromate and nonchromate products.

There were concerns that none of the test primers nor the controls passed all of the tests specified in the JTP. The fact that controls failed some of the tests proves that laboratory test requirements have evolved in severity to find differences among top performing chromate primers. Despite these concerns, the technical representatives weighed the comparative differences between the test primers and controls and reached a consensus to initiate the operational performance testing.

Operational testing of the two nonchromate primers is under way on F/A-18, F-15, T-45, Harpoon SLAM missile canisters, and AV-8B weapon systems. PRC DeSoto EWAE-118 primer was applied to the F/A-18 and AV-8B aircraft and Dexter 10PW22-2 was applied to the F-15, T-45, and harpoon Canisters as follows:

- Seven (7) F/A-18s (one half of each aircraft) for 4 years duration with a minimum of two six month deployments aboard an aircraft carrier

- Two (2) F-15s (One wing on each aircraft) for six years duration
- One (1) 1 ship-board Harpoon Canister with chrome primer and one nonchrome primer for two years duration
- Three (3) T-45s with selected removable panels and one additional aircraft will use nonchrome primer for all maintenance touch-up for four years duration
- One (1) AV-8B flight tests to evaluate high temperature capability.

Test units are inspected by DoD representatives from the participating programs, Navy and Air Force material labs, corrosion offices, and B-A&M on an annual basis and after carrier deployments to assess primer performance. Mid-term operational testing results are as follows:

- F/A-18s: There was no conclusive indication that the nonchromate primer is performing significantly different than the chromate primer but there were more corrosion sites found on the nonchrome primer sides of some aircraft due to aircraft configuration differences.
- F-15: Based on the two year inspection results of both aircraft there was clearly better adhesion with the chromate solvent-borne control primer to the titanium skins and to certain areas of the aluminum skins on the underside of the wing.
- Harpoon Canisters: The two test canisters, one with chrome free primer and one with chromate primer, did not perform as well as the non-test units indicating that the test units were not equivalent to production units. The nonchrome primer did not perform as well as the chromate primer but the fact that neither of the test canisters performed well, relative to the non-test canisters, indicates that the test may not accurately depict production use of nonchrome primer.
- T-45: Overall test results do not reveal a performance difference between the nonchromate test primer and the chromate control primer on the T-45.
- AV-8B: After one year of flight testing there are no differences noted between the chromate and nonchromate test primer.

Success of the JG-PP operational test phase will be based on the performance of nonchromate primer relative to the baseline chromate primer. If the operational testing proves successful, the chromate exterior primer on some B-A&M St. Louis military aircraft could be replaced with a nonchromate product in 2002.

For further information regarding this article please contact Mr. Larry Triplett, B-A&M, at (314) 232-2882 or visit the JG-PP web site at: http://www.jgpp.com.

Source: 4th Annual Joint Services, Pollution Prevention/Hazardous Waste Management Conference & Exhibition Proceedings, San Antonio, TX, Dec. 1999 ◆

Continued from page 5

several stakeholder meetings in North Carolina during 1998 and 1999 to discuss the progress of the rule, and recently EPA sent stakeholders a summary of EPA's analysis of the data from the 1998 MMPP questionnaires. Because so many industrial sectors and so many metal products may be affected by the rule, data analysis is complex.

Rather than attempting to hold another large stakeholder meeting to discuss feedback from the data analysis, EPA has decided to hold a series of 2-hour conference calls with each of the various industry sectors. A federal facilities conference call was held in February and in March a conference call was held for the aerospace equipment sector.

Aerospace Industry Association (AIA) has formed an MMPP Task Group to provide input to EPA during the progress of the rule and to coordinate our input with that of our customers: especially DoD and the services, NASA, and the airlines. EPA expects to propose the MMPP NESHAP in November of 2001, though recent budget cutbacks could affect that date. More information on the MMPP can be found at the EPA web site: www.epa.gov/ttn/uatw/coat/misc/misc_met.html.

This article was written by Glynn Rountree, Aerospace Industry Association ◆

EDWARDS AFB IMPLEMENTS ENVIRONMENTAL LOGISTICS TEST & EVALUATION INTO ACQUISITION DEVELOPMENT

The Air Force Flight Test Center (AFFTC), located at Edwards AFB, performs testing and evaluation of new and existing aircraft weapon systems. A key aspect of the AFFTC mission is to test and evaluate new/modified aircraft weapon systems in the engineering and manufacturing development, production, fielding/deployment, and operational support phases of a weapon system acquisition and service life. AFFTC tests the maintenance characteristics of all weapon systems before actual production and fielding/deployment. Therefore, weapon systems can be modified to address maintainability and sustainability concerns before production and deployment. This avoids the much more expensive process of modifying weapon systems after production and deployment. At AFFTC, this evaluation is known as the Logistics Test and Evaluation (LT&E) process.

Historically, weapon system environmental requirements and impacts have not been included in the LT&E process. Since the costs of these environmental requirements and impacts can be considerable over the life cycle of a weapon system, the Air Force Pollution Prevention Program has focused much effort on trying to reduce hazardous material (HazMat) usage in and generation of hazardous waste generated from weapon systems. However, much of this effort has been directed at modifying weapon systems well after production and deployment, the most expensive approach possible.

By adding an environmental element to LT&E, the evaluation process becomes a platform to identify and correct environmental concerns in weapon systems prior to production and deployment. As the result of the joint efforts of the AFFTC Environmental Quality Division Pollution Prevention Branch (EMCP) and the 412th Logistics Support Squadron, an environmental element was added to the existing LT&E tool. As a result, the Environmental Logistics Test and Evaluation (Environmental LT&E) process has been seamlessly integrated into the existing process.

As in the LT&E, the maintainers accomplish the Environmental LT&E of weapon system/subsystem by answering logistic test measure (LTM) questions. The environmental LTM questions incorporated into the ten integrated logistic support elements (the basic components of a weapon system/subsystem's logistics support requirements) are summarized in Table 3. Based on the maintainer's comments to these questions and an overall score, an environmental evaluation may be initiated. This evaluation determines if alternate HazMat can be used, or if processes can be modified to reduce hazardous waste. Recommendations are then made to the appropriate test customers who can then make decisions on modifications to the tested weapon system.

ELT&E Case Studies

Since the development of the Environmental LT&E process, EMCP has accomplished or identified six test cases for Environmental LT&E demonstration/validation. These case studies are summarized below.

F-15 Post Flight Maintenance (Antenna Sealant): The Environmental LT&E process identified a two-part adhesive that was being issued in a 6-ounce applicator that was too large, creating unnecessary waste. A 2.5-ounce applicator was identified as a replacement, with a 10-year life-cycle cost savings of $100K.

Solvent Cleaning of Aircraft Components: The Environmental LT&E process evaluated alternatives to a jet engine bearing cleaning solvent. A less toxic solvent was T.O. approved which minimize nuisance odor problems, had the same level of cleaning efficiency, and reduced worker's exposure risks. Life-cycle cost savings are under evaluation.

Lubricating (Anti-seize) Compound: The Environmental LT&E process evaluated a substitute jet engine rod anti-seize compound. The proposed alternative, a brush-on bake-on compound, proved better than the original compound. The alternative has superior properties, less health risks for maintainers, and eliminates an ozone depleting substance. Life-cycle cost savings are under evaluation.

Dry Ice (Engine Shaft Replacement): The practice of producing dry ice for propulsion shop maintenance activities was evaluated. The Environmental LT&E process recommended use of a dry-ice making machine to replace procuring and storing. The results indicate a 10-year life-cycle cost savings of $130K.

Environmental Logistic Test Measure (LTM) Questions Added to the Integrated Logistic Support Elements
1. Maintenance Planning: *LTM-5 - Environmental Impact: (E) Was the time required to Perform the task affected by handling controlled consumables?* The maintainers check and record the time required to don appropriate personal protective equipment, obtain controlled consumables from the Pharmacy, dispose of waste, and perform other necessary activities. These data determine when a disproportionate amount of time is required to manage controlled consumables.
2. Manpower and Personnel: *LTM-27 - Crew Impact: (E) Was the TO's specified crew size sufficient to handle environmental issues (e.g., trips to pharmacy, control equipment, record keeping, waste disposal, spill response)?* This environmental LTM focuses on the adequacy of crew size, as specified by the TO, for carrying out environmental tasks. If the number of people is insufficient for a task, the evaluator will investigate the cause and determine if changes will bring the crew size back to the specified level.
3. Support Equipment: *LTM-38 - Emissions: (E) Rate the adequacy of the environmental SE. Please check the equipment that was necessary to complete this task.* This environmental LTM provides qualitative data on the use of paint booths, spray guns, personal protective equipment, etc. The results determine how well the equipment performs the necessary functions.
4. Supply Support: *LTM-43 - Disposal Control: (E) Rate the adequacy of the controlled consumables (e.g., shelf life problem, provisions for disposal).* The maintainers rate and identify controlled consumables and record information on which portions are returned unused, returned for disposal, or recycled.
5. Technical Data: *LTM-56 - Specified Consumables: (E) Rate the instructions for and performance of the TO specified consumable. Are there know substitute consumables that are less hazardous?* This environmental LTM evaluates the instructions in the TO for controlled consumables. This ensures that the instructions are adequate and understandable. In addition, the maintainer suggests suitable environmental substitutes within their knowledge.
6. Training and Training Support: *LTM-66 - Hazardous Materials Training: (E) Rate the adequacy of training to handle the identified controlled consumable and operate environmental control equipment.* This environmental LTM ensures that adequate training is offered on hazardous materials handling and operation of control equipment. If deficiencies are identified, the evaluator suggests changes to reduce personal injuries or hazardous material releases.
7. Computer Resource Support: There is no environmental LTM for this ILS element.
8. Facilities: *LTM-85 - Pollutant Control: (E) Rate the ability of the facilities (i.e., paint booth, clean room, and tank farm) to prevent uncontrolled releases to the environment.* This environmental LTM addresses pollution control and evaluates the facilities' abilities to prevent exposures to personnel and uncontrolled releases to the environment.
9. Packaging, Handling, Storage, and Transportation: *LTM-93 - Effectiveness: (E) Rate the adequacy of packaging to deal with controlled consumables (e.g., inappropriate quantities, mixing 6 ounces of sealant when only one ounce is required).* This environmental LTM aids the evaluator in determining if appropriate packaging for controlled consumables exists. The maintainers offer their suggestions for improved packaging procedures.
10. Design Interface: *LTM-107 - Pollution Minimization: (E) Rate the adequacy of the design features to minimize environmental hazards.* The maintainers provides information on the system's environmental impacts.

Table 3. Environmental LTM Questions Added to the Integrated Logistic Support Elements

Form-A-Gasket (F-15 Engine Assembly): The Environmental LT&E process identified three substitute jet engine gasket forming/sealing compounds to replace a T.O. specified sealant. An environmental and life-cycle cost analysis will be performed to help identify the preferred alternative.

Engine Preservation: Hot- and cold-engine preservation techniques were compared through the Environmental LT&E process. An environmental and lifecycle cost analysis indicated no appreciable difference in environmental effects, and no discernable cost difference between the two techniques.

To date, the demonstration/validation of the Environmental LT&E process has already identified $230,000 in immediate life-cycle cost savings in weapon system maintenance. As part of its continuing effort, EMCP is continuing with its demonstration/validation of the Environmental LT&E process by applying another 20 test cases to produce a final Environmental LT&E process that is refined and robust.

For further information regarding the Environmental LT&E process, please contact Ms. Mary Spencer, Edwards AFB, and Dr. Hans Beutelman, Tybrin Corporation at DSN 527-1466.

Source: Dr. Hans Beutelman, Tybrin Corporation ◆

POLLUTION PREVENTION AT AIR FORCE PLANT 4

Air Force Plant 4 in Fort Worth, Texas is home to Lockheed Martin Aeronautics Company, (LM Aero). AFP 4 is a 7 million square foot facility and currently provides the design, fabrication, assembly, and testing facilities necessary to produce the F-16 fighter, the center fuselage for the F-22 fighter, and various other aerospace components and products.

A large number of chemical products and processes are required to achieve the complex manufacturing goals. A variety of chemicals are used in the fabrication, production, and testing operations conducted at the facility. These chemicals include solvents, coatings, adhesives, wastewater treatment chemicals, oils and fuels, coolants, caustics, and acids. Since the early 1980s, a pollution prevention program has been in place at LM Aero to eliminate or minimize the use of hazardous chemicals and processes.

Organizational Structure

The pollution prevention program at Air Force Plant 4 traces its roots back to the General Dynamics Corporation's zero discharge policy. A team approach has been used throughout the entire effort. Significant progress has been made under two different organizational schemes, the informal "wheel" approach where individual departments and organizations were encouraged, with management support, to become players; and the more formalized Hazardous Material Management Program (HMMP) approach.

Accomplishments

The elimination and reduction of hazardous materials has saved millions of dollars in disposal and environmental compliance costs as well as providing a cleaner, safer, and healthier environment in which to work and live. Calculations have shown savings in excess of $35 million for waste disposal costs alone. A number of individual projects were undertaken in order to achieve the above results. Among the most noteworthy projects were the replacement of wipe solvents, elimination of ozone depleting substances (ODS), and the reduction of EPA-17 chemicals.

A number of pollution prevention projects are ongoing at the present time. Several of these projects are the result of a multi-million dollar program, funded by the F-16 Program, to continue eliminating EPA-17 chemicals and reduce/eliminate other hazardous chemicals.

One of the major thrusts of this program is a series of projects to eliminate hexavalent chromium compounds from military aircraft procurement programs. Hexavalent chromium represents a significant hazard to human health as well as to the environment. Wastes from products containing chromium are generally hazardous and require expensive waste treatment and/or disposal. Elimination of hexavalent chromium will represent a significant life-cycle benefit for all aircraft procurement and maintenance programs.

Chrome elimination projects funded by the F-16 Program at LM Aero include the following:
- Non-chromated sealant for use on the F-16 fighter.
- Non-chromated coatings, including primers.
- Non-chromated deoxidizer bath.
- Non-chromated pre-bond etchant.
- Non-chromated conversion coating for aluminum.

Other projects supported by the F-16 funded program include:
- Replacement for cadmium plating. (See related summary on page 11)
- Replacements for miscellaneous solvents.
- Non-hap depainting.
- Replacements for high VOC coatings. (See related summary on page 11)
- Replacement for lead containing solid film lube.
- Non-hap dot stencil ink.

For further information about LM Aero's P2 Program, please contact Ed Daniels, LM Aero, at (817) 777-6951.

Source: Ed Daniels, LM Aero ◆

F-16/LM AERO CADMIUM REPLACEMENT PROJECT

The objective of this project is to identify alternative protective coatings or processes that will reduce or eliminate hazards presented by cadmium. The F-16 inlet area, where the major grinding and sanding operations are performed, is the first area of concentration. Threaded fasteners on other parts of the aircraft will also be addressed, as well as electrical connectors, landing gear parts, and other components. Candidate solutions include Ion Vapor Deposited (IVD) aluminum, aluminum plating, zinc nickel, tin zinc, and others, each of which has positive and negative characteristics for each application category.

Accomplishments for this project include the implementation of aluminum-coated MS90353 fasteners in the inlet to replace cadmium-plated fasteners subject to sanding and grinding; and to reduce compliance costs associated with inlet manufacture.

Next actions for this task include, determining feasibility of aluminum coated blind fasteners for entire aircraft (inlet fasteners) and testing of electroplated aluminum coated electrical connectors.

There are no clear-cut candidates for threaded fastener applications. Some of the fastener manufacturers are looking at the AlumiPlate process, but pure aluminum is probably not lubricious enough. The Navy is looking at an aluminum-manganese that might increase the lubricity. Many of the cadmium applications would require large cost increases which may be prohibitive. Landing gear changes are one example of this.

There also seems to be an increasing interest in cadmium replacement on electrical connectors. Aluminum is a potentially good substitute, however a chromated conversion coating film over the base coating would probably still be required.

For further information regarding this project, please contact Ms. Mary Wyderski, F-16, at DSN 986-6178, or Mr. Jerry Brown, LMAero, at (817) 777-2150.◆

F-16/LM AERO PROJECT TO REPLACE HIGH VOC COATINGS

The objective of this project is to identify, test, and qualify lower-VOC alternatives for the higher priority materials. This task will initially address an adhesion promoter, epoxy topcoat, fuel tank coating, nitrile-phenolic primer, rubber-based adhesive, moisture resistant spray coating, anti-chafe coating, urethane topcoat, and release agent. Additional materials may be investigated as time and need permit.

Accomplishments of this project include:

- Implemented 3M low-VOC adhesive (1099) for FMS-1015, Form III brush-on application (VOC savings of 5.3 lb./gal)
- Spraylat HS-611 implemented as a MIL-C-22750 topcoat for electronic enclosures and other internal areas (VOC savings of 2.7 lb./gal- 49% reduction)
- MIL-P-23377 or MIL-P-85582 implemented as replacements for TT-P-1757 as primer for sleeves and bushings (VOC savings of 2.2lb/gal –44% reduction)
- Dexter Aqualine C-210 implemented as replacement for P6176-1 (Epoxical) release agent for high temperature press application (VOC savings of 6.4 lb./gal – 98% reduction)
- Deft 18BK004 black urethane FMS-1027 Type V material implemented as a replacement for FMS-1027 Type IV Anti Chafe Coating (VOC savings of 2.2 lb./gal – 39% reduction).

Next actions for this project include:

- Procurement of new material for Adhesion Promoter (P6140)
- Begin implementation and resolution of issues with F-22, for Fuel Tank Coating (MIL-C-277725)
- Perform preliminary assessment of SIA 811-S set time and tackiness for Rubber-based Adhesive (FMS-1015 Form III)
- Find moisture exposure limit of SIA 811-S coating for moisture-resistant spray coating (P6028)
- Complete remaining qualification tests for Urethane Topcoat (MIL-C-85285)
- Screen candidate materials for bonded assembly application and qualify and implement any material successfully passing screening tests for release agent (P6176).

For further information regarding this project, please contact Ms. Mary Wyderski, F-16, at DSN 986-6178, or Mr. Jerry Brown, LMAero, at (817) 777-2150.◆

NON CLASS 1 OZONE DEPLETING CHEMICAL, OXYGEN SYSTEM COMPONENT CLEANING AND CLEANLINESS VERIFICATION PROCESS

Federal regulations and corporate goals have created the need to qualify a replacement for trichlorotrifluoroethane (CFC-113), a class I Ozone Depleting Chemical (ODC) used in support of oxygen system component cleaning for the B-2 bomber. The current cleaning process for tube assemblies for the primary and back-up oxygen systems, which come into contact with lubricants and shop soils and could jeopardize aircraft safety if not sufficiently removed, involves pre-cleaning using Brulin 815GD™ in an immersion tank and final cleaning with CFC-113. An extracted sample of CFC-113 is analyzed to determine the cleanliness level of the interior of the tube assembly.

The proposed oxygen system component cleaning process utilizes the Proceco™ aqueous degreaser for pre-cleaning, by pumping cleaning solution, rinse water, and air through a manifold and directing it into the tubes and overhead spray nozzles. In order to facilitate the efficient implementation of a non-class I ODC as a final cleaning step and verification solvent, a portable cart was designed and built for the tube shop. The solvent cart is equipped with fittings to accommodate the various sized tubes and a solvent reservoir, filter and pump to circulate the fluid in a closed fashion. This minimizes worker contact with the fluid as well as solvent emissions from the process.

Northrop Grumman implemented an aqueous tube cleaning process in their Palmdale facility to support production of B-2 hydraulic tubes. It was found that the aqueous cleaning process achieved a significantly higher cleanliness level than the vapor degreasing process that was previously used. It was believed that the process could be used to support the final cleaning and verification of the tubes used in the primary and back-up oxygen system on the B-2. The Proceco™ aqueous parts washer operated with Brulin 1990GD™ was qualified as a pre-cleaning process for the low-pressure oxygen system components.

Before the process could be implemented in the Palmdale facility, a non-ODC cleanliness verification solvent had to be qualified. Two solvents, Asahiklin AK-225™ and Dupont Vertrel MCA™ were selected as candidates for the qualification program based on a literature review. Testing performed included cleaning efficiency, particle count determination, and non-volatile residue measurement. Based on the results of the testing both were found to be acceptable alternatives to the baseline material CFC-113. AK-225™ was selected as the replacement solvent because of its superior performance in removing the shop soils encountered in the B-2 production area.

One issue needs to be addressed to assure the successful implementation of an alternate cleanliness verification solvent. The use of an extractive verification method analyzes the fluid rather than direct analysis of the part. Therefore, the results are dependent on the performance of the flushing fluid. Cleanliness standards commonly used in the industry are based on CFC-113 and do not account for stronger or weaker solvents. When using more aggressive solvents for cleanliness verification higher particle counts or NVR's will be found and it may be necessary to perform additional solvent flushes to meet the system requirement.

Whiteman AFB has generated a "letter of interest" in evaluating a modified portable solvent flushing cart for base level cleaning and verification of B-2 oxygen system components. Following validation of the process at NGC, the System Program Office, Whiteman AFB and NGC will seek funding to transition the process for use at WAFB. The new process will require modifications to meet the unique needs of the Air Combat Command. ACC has indicated a need for cap and tool cleaning which will require the addition of a glove box attachment, a distillation unit and possibly a separate cleaning reservoir. NGC has started to coordinate the design of the portable flushing system with WAFB maintenance personnel.

The NGC portable cleaning system will be applicable to all DoD services, and will contribute to the elimination of class 1 ODC materials. NGC has been asked to participate in a project supported by the Joint Group on Pollution Prevention (JG-PP), along with Tinker AFB and the Navy. Tinker AFB has developed a system level cleaning process for the B-1 and the Navy is implementing a solvent flushing system using the NOC aqueous cleaner.

For additional information regarding this article, please contact Mr. Stan Bean, Northrop Grumman at (562) 942-6778.

Source: 4th Annual Joint Services, Pollution Prevention/Hazardous Waste Management Conference & Exhibition Proceedings, San Antonio, TX, Dec. 1999 ◆

NEW AIR EMISSIONS INVENTORY GUIDANCE DOCUMENT FOR AIR FORCE INSTALLATIONS

The Air Quality Branch of the Institute for Environment, Safety & Occupational Health Risk Analysis (IERA/RSEQ) recently prepared a new guidance document entitled *Air Emissions Inventory (AEI) Guidance Document for Stationary Sources at Air Force Installations.* This new guidance provides a uniform and logical approach for preparing AEIs by providing recommended methodologies for calculating both actual and potential emissions from more than 30 of the most common types of stationary sources found on Air Force Installations. The document also provides a description of each source type along with easy to follow example problems. It addresses emissions of criteria pollutants, hazardous air pollutants (HAPs), and ozone depleting substances (ODSs).

Inventory Background Information: The introduction section of IERA/RSEQ's new AEI guidance document provides useful background information to assist air quality personnel in identifying the inventory requirements/needs specific to their installations. This includes a summary of the methodologies used to calculate emissions, a description of the common pollutants typically addressed in AEIs, a summary of the regulatory requirements pertaining to AEIs, a listing of other uses for AEIs, and a discussion on how AEIs are utilized to make major source determinations under Titles III and V of the 1990 Clean Air Act amendments. It addresses three classes of pollutants that are most commonly regulated at Air Force installations: criteria pollutants, HAPs, and ODSs.

Source Types and Calculation Methodologies: The new AEI guidance document contains individual sections for over 30 different types of air emission sources. Each section is comprised of the following subsections: Background, Emission Calculations, Information Resources, Example Problems, and References.

Summaries of some of the more unique calculation methodologies found in the new AEI guidance document are provided in Table 4 (See Page 14).

Other sources specifically addressed in the AEI guidance document include: asphalt paving, chromium electroplating, dry cleaning, fuel equipment leaks, ethylene oxide sterilizers, heavy construction operations, landfills, miscellaneous chemical use, non-destructive inspection operations, open/prescribed burning, pesticide application, solvent cleaning machines, surface coating application, waste solvent reclamation, wastewater treatment plants, welding, and wet cooling towers.

Potential to Emit Methodologies: In general, the PTE methodologies recommended in the AEI guidance document involve multiplying actual emissions by a factor that is based on the possible increase in base operations related to the source type. For example, PTE for flightline maintenance activities can be calculated by multiplying actual emissions times the ratio of the potential number of aircraft the installation can support to the average number of aircraft actually assigned to the installation during the inventory year.

Additional Information: The appendices of the AEI guidance contain additional useful information including: two listings of the HAPs, a table summarizing the data elements needed to calculate emissions from different types of sources, a recommended format for AEI reports, a listing of two-digit Standard Industrial Classification (SIC) codes, and a listing of common abbreviations/acronyms related to AEIs.

Conclusion: Air Force installations are required to prepare AEIs to comply with applicable federal, state, and local air quality regulations. In addition, AEIs have become an effective tool in the implementation of various environmental programs, such as pollution prevention opportunities, emissions trading, risk assessments, and environmental auditing. IERA/RSEQ's new AEI guidance document is a convenient and useful tool that Air Force personnel and their contractors can use to accurately, and uniformly, prepare air emissions inventories. Copies of the guidance document can be obtained by contacting the Air Quality section of IERA/RSEQ, the Defense Technical Information Center (DTIC), the National Technical Information Services (NTIS); or from IERA/RSEQ's website (http://sg-www.satx.disa.mil/iera/rse/airtool.htm).

For further information regarding this article, please contact Robert O'Brien, IERA at DSN 240-4973 or commercial (210) 536-4973.

Source: 4th Annual Joint Services, Pollution Prevention/Hazardous Waste Management Conference & Exhibition Proceedings, San Antonio, TX, Dec. 1999 ◆

SOURCE TYPE	AEI GUIDANCE DOCUMENT CALCULATION METHODOLOGIES
External Combustion Equipment	➡Multiply the quantity of fuel combusted times the appropriate emission factor (emission factors are consolidated in one location within the guidance document)
Fuel Evaporation Sources	➡Standard EPA methodologies ➡Guidance for calculating HAP emissions from fuel evaporative sources using liquid phase and vapor phase speciation
Abrasive Blasting and Woodworking	➡Calculate particulate emissions based on the efficiency of the control device and the amount of waste material collected by the control device during the year.
Fire Fighter Training	➡AEI guidance incorporates emission factors for the open burning of propane and JP-8 allowing easy calculations based on the total amount of each fuel burned during the year.
Fuel Cell Maintenance ➡Fuel cell purging ➡Fire-suppressant	➡Equation included in the AEI guidance calculating emissions for a particular type of aircraft fuel cell by knowing the volume of the fuel cell and the number of similar cells purged during the year ➡Simple Mass Balance approach
Laboratory Chemicals	➡Emissions are estimated by assuming 13% of the total amount of chemical used evaporates
Open Burning/Open Detonation of Energetic Materials	➡Emission factors from a draft EPA report are incorporated into the guidance
Site Restoration	➡Method derived from EPA report *Estimating Air Emissions from Petroleum UST Cleanups* ➡Easy to use equations included in guidance document
Small Arms Firing ➡CO ➡Pb	➡Multiplication of the mass of energetic material times the number of rounds fired per year times the CO emission factor ➡Assumption that the entire quantity of lead compounds contained in the ammunition's energetic material is emitted when fired ➡AEI guidance includes tables listing the mass energetic material and quantity of lead compounds found in common types of small arms ammunition
Aircraft Engine Testing	➡Multiplication of the total amount of fuel a particular type of engine burns at a specific power setting times the "lb/1000lb" emission factor specific to the engine and power setting ➡Specifies the use of new emission factors for engines burning JP-8 (or JP-5) fuel

Table 4. Summary of Calculations Methodologies

APPLYING POLLUTION PREVENTION TO AIR QUALITY PROGRAMS

Science Applications International Corporation (SAIC) was tasked by Eglin Air Force Base, FL, to evaluate their operations and activities for the purpose of identifying those that could be changed to assist the installation in reducing air emissions, regulatory exposure, and permitting and labor costs. Evaluations in this study focused on Pollution Prevention (P2) concepts and techniques to minimize or eliminate air emissions at the base. Substantial benefits from incorporating P2 into air programs include cost savings, annual permit fees, disposal costs, regulatory relief and reduced liability, and reduction or elimination of monitoring, recordkeeping and reporting. All existing air emissions data sources at the base were analyzed for this study and used to identify 31 key shops, grouped under a variety of source categories, which comprised the majority of air emissions.

Root cause analysis methodology was used to develop potential P2 options. As part of this approach, a series of detailed process flow diagrams (PFDs) were created to document all processes evaluated, help identify the root causes of emissions in each process, and help develop appropriate P2 options.

The study resulted in the development and evaluation of a total of approximately 90 potential P2 options. The overall strategy in developing these options was to first reduce the number of times that a specific activity must be performed, then to reduce the emissions created from individual steps when that specific activity is performed.

Using root cause analysis techniques, several innovative approaches to reducing air emissions were identified. Examples include using protective covers on vehicles exposed to harsh environmental conditions and renewable coatings on aircrafts to extend the lifetime of the paint. Other potential options developed include revising jet engine maintenance procedures to reduce repeated testing, and instituting new training, including the use of mockups, for fuel cell repair personnel in order to eliminate some routine repairs. Five projects were retained for further evaluation because their implementation would require significant funding. These projects were: implementation of a carpooling program at the base, reinstallation of Stage II Vapor Recovery Systems at AAFES gas stations, installation of vapor recovery systems at government fuel load racks, application of StonGard™ paint protection system on range vehicles, and purchase of vehicle protection covers for vehicles exposed to a saltwater spray environment. The first three projects would reduce emissions associated with vehicle refueling operations, while the latter two projects would extend the time before vehicles required re-painting, minimizing emissions from surface coating operations.

Additional P2 opportunities were identified that did not necessarily apply to individual shops. For example, SAIC recommended organization of a series of working groups comprised of base personnel to evaluate/share pollution prevention ideas, since P2 experiences at the base are often not communicated to other shops. SAIC also identified a more accurate methodology for performing air emission inventory calculations such as utilizing updated emission factors and/or different sources of input data.

As part of this effort, SAIC also imported into the Eglin GIS all PFDs developed during the study and a web page for each of the Title V regulated air emission sources on the base. The web data will be used to educate regulators, base personnel, and public interest groups on the status and progress of the Eglin AFB Air Quality Program.

For further information regarding this article, please contact Duis Diaz, SAIC at (813) 835-5606.

Source: 4th Annual Joint Services, Pollution Prevention/Hazardous Waste Management Conference & Exhibition Proceedings, San Antonio, TX, Dec. 1999.◆

PURIFY AND REUSE WASTE AIRCRAFT HYDRAULIC FLUID

The USAF spends approximately $30 million per year in the disposal and replacement of used hydraulic fluid, which could be saved if it was purified and reused. The Air Force Research Laboratory, Materials and Manufacturing Directorate, Airbase and Environmental Technology Division (AFRL/MLQ), Tyndall AFB, Florida is sponsoring a project that will enable the Air Force to realize these savings. Through regular use, accumulation of particulate matter and water requires the disposal of waste hydraulic fluid. The Air Force generated a need to evaluate economical equipment and/or processes that would allow the USAF to reuse the contaminated hydraulic fluid. In response, AFRL/MLQ began a hydraulic fluid purification project.

A portable hydraulic fluid purifier manufactured by Pall Aeropower Corporation was chosen for evaluation because it uses a vacuum dehydration, spinning disc process to remove water, air, and volatile organic solvents. It also incorporates a filtration system to remove particulate matter.

The initial testing in 1995 evaluated the Pall purifier at Tyndall AFB, in an environmentally controlled facility using new and used hydraulic fluids. Each of the new hydraulic fluids was deliberately contaminated with measured amounts of deionized water and one gram of AC fine test dust at hourly intervals. The Pall purifier was operated for a total of 18.5 hours for each of the six hydraulic fluids evaluated. Three samples were collected from each of the fluids that included: unpurified (baseline), after 8 hours, and after 18.5 hours. The fluid samples were analyzed for degradation by analyzing for viscosity, acid number, rubber swell, water content, lubricity, evaporation, and oxidation-corrosion. The initial evaluation indicated that the Pall purifier effectively removed the water and particulate but did not degrade the properties of the fluids processed.

AFRL/MLSE recommended wear testing on aircraft hydraulic fluid pumps to determine the impact of fluid purification on pump life/performance. The F-16 emergency power unit (EPU) pump and the main hydraulic fluid pump were selected for these tests. The first pump wear test compared pump wear between tow F-16 EPU pumps, operated under load, with both purified and unpurified (new) hydraulic fluid. At the conclusion of the tests, there was no apparent difference in pump performance and no significant difference between fluid properties, with either purified or unpurified fluid. The second pump wear test compared pump wear between F-16 aircraft main hydraulic

fluid pumps, operated under load, with purified and unpurified hydraulic fluid. There was no apparent difference in pump performance with either purified or unpurified fluid.

Headquarters Air Mobility Command (HQ AMC) conducted an operational utility evaluation (OUE) on the Pall purifier. This purifier incorporates a state-of-the-art water sensor that automatically shuts of the equipment after a preset level of cleanliness has been reached. The OUE determined the purifier sufficiently cleaned hydraulic fluid without degrading fluid characteristics and that the purifier is logistically supportable.

The results of the initial evaluation and Pump Wear Tests #1 & #2 should encourage consumers of large quantities of hydraulic fluid to consider purifying contaminated hydraulic fluid for reuse instead of immediate disposal. Note: Hydraulic fluid contaminated with other oils or fuel cannot be purified and reused though this process because it will not separate them.

The average Air Force base can expect to invest less than $34K (for two Pall purifiers) to reap full benefits of this process, which can be expected to reduce waste hydraulic fluid by 75%. It should be noted that the U.S. Army has approved the use of purified MIL-H-46170 and MIL-H-6083 hydraulic fluid used in their ground systems.

For further information regarding this article, please contact Ed Seaman, TRW at DSN 523-6290 or Neal Werner, Pall Aeropower Corporation, at (727) 539-8448.

Source: 4th Annual Joint Services, Pollution Prevention/Hazardous Waste Management Conference & Exhibition Proceedings, San Antonio, TX, Dec. 1999.◆

ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM FOR METAL FINISHING POLLUTION PREVENTION

The U.S. EPA has instituted the Environmental Technology Verification Program (ETV) to verify the performance of innovative technical solutions to problems that may effect human health or the environments and to substantially accelerate the entrance of new environmental technologies into the domestic and international marketplace. The Environmental Technology Verification Program for P2 Metal Finishing Technologies (ETV-MF) provides verification testing of environmental technologies intended for reducing pollution in the metal finishing industry. The goal of the program is to verify the performance characteristics of commercial ready metal finishing P2 technologies through unbiased third party testing under actual operating conditions in metal finishing shops nationwide. Company and product names are directly linked to the verification results. Test results of one technology are not compared to other technologies, as testing is conducted to determine the performance of a single technology under specific, predetermined test criteria.

During the organizational phase of the program a quality management plan was developed and approved by the EPA defining the overall program quality management system, and quality requirements. A Stakeholder Group comprised of technology suppliers and metal finishers, technical/trade associations, Federal and State Government, and industry consultants was selected to guide the direction of the ETV-MF Pilot. The Stakeholder Group has identified four focus areas for which technologies have been solicited: (1) mineral acid bath maintenance, and (2) electroless nickel bath maintenance, (3) aqueous cleaner bath maintenance, and (4) chromate conversion coating solution maintenance.

The general requirements for testing metal finishing P2 technologies is included in a generic verification protocol used by the technology suppliers and ETV-MF to jointly develop test plans. It established benchmarks for experimental reporting and ensures all pertinent information related to the tests are considered including:

- General description of the technologies, applications and operating principles
- Responsibilities of all involved organizations
- Test goals and objectives
- Experimental methodology
- Description and use of field test sites
- Description and use of analytical laboratories
- QA/QC objectives, requirements and audits
- Data reduction, validation and reporting
- Testing organization and management
- Environmental, health and safety requirements

During the operational phase the ETV-MF verification process occurs. P2 technology suppliers volunteer to have their technologies tested by responding to public solicitation. The ETV-MF Verification Testing Process is as follows:

- Focus area chosen
- Request for technologies issued

- Review of responses complete
- Test plans finalized
- Verification testing performed
- Verification report and statement issued.

Thirteen suppliers volunteered to have their technologies tested under the program (Table 6). Using the generic verification protocol as a guide, test plans are currently being prepared for the two aqueous cleaner bath maintenance technologies. The test plans will include performance criteria specified by the technology suppliers and environmental performance criteria recommended by the stakeholders.

An alternate verification testing approach, called generic technology verification, is currently being evaluated. It would test technology by functions or classes, rather than specific commercial products as is done with standard technology verification. Company names would not be linked to the test results, but instead would be acknowledged in the test report.

Verification testing of the two aqueous cleaner bath maintenance technologies is scheduled during the winter of 2000 under supervision of an ETV-MF project Team. Verification reports will be posted on the EPA ETV and ETV-MF websites (www.epa.gov/etv and www.etv-mf.org) after final EPA approval.

For further information regarding this article, please contact Jim Voytko, Concurrent Technologies Corporation at (727) 549-7006.

Source: 4th Annual Joint Services, Pollution Prevention/Hazardous Waste Management Conference & Exhibition Proceedings, San Antonio, TX, Dec. 1999.◆

Vendor	Technology Name	Technology Type	Applications(s)
US Filter/Pure Cycle Team	Acid Recycling Technology	Diffusion Dialysis	Methane Sulfonic, Hydrochloric, Nitric, and Sulfuric Acid
Zero Discharge Technologies, Inc.	Acid Recycling System	Diffusion Dialysis	Hydrochloric, Nitric, and Sulfuric, Hydrochloric and Other Acids
Zero Discharge Technologies, Inc.	Electroless Nickel Electrodialysis	Electrodialysis	Electroless Nickel
MacDermid, Inc/Pure Cycle Team	Electroless Nickel Electrodialysis Technology	Electrodialysis	Electroless Nickel
Renovare International, Inc.	RenoCell	Electrodeposition	Removes heavy metals, except chromium, from rinsewater, ion exchange regenerant, process wastes, and etchant solutions
US Filter	RETEC Separated Cell Recovery (SCR) or Purification (SCP)	Electrodialysis	Removes chromium, nickel, chromic acid, sulfuric and phosphoric acids from rinsewater and concentrated baths
US Filter	Silverback Aqueous Cleaner Recycle System	Microfiltration	Removes oil/grease & TSS from alkaline and acid cleaning baths
Commodore Separation Technologies, Inc.	SLiM 50	Supported Liquid Membrane/Diffusion	Removes heavy metals, (Cr, Cu, Zn, Ni, Co) from rinsewater and wastewater for reuse or recycle
Eaton Corp. Hardwaco, Ltd. Team	Mechanical Vapor Recompression Evaporator	Evaporator	Large scale (10,000 gpd) closed loop system for metal bearing wastestreams
The MART Corporation	MART EQ-Wastewater Treatment System	Coagulation	Removes oil/grease, heavy metals, TSS, and organics from wastewater and recycles water
Bio Clean USA, LLC	Bio Clean System	Microbiological Degreasing System	Employs microbes to consume oils from aqueous cleaning baths, can replace aqueous or solvent degreasing systems & recycles water
Environmental Research and Development, Inc.	Neutral Process Technology	Metal Precipitation and Microfiltration	Removes all heavy metals from wastewater and recycles water
Infinity Chemicals Group	Infinity Prep-L	Deoxidizing Chemical Pretreatment	Biodegradable, non-hazardous pretreatment chemical that removes metal oxides and organics, replaces acid activation baths

Table 6. Initial Verification Testing Technologies

POLLUTION PREVENTION MODEL SHOP REPORT UPDATE: AIR FORCE AIRCRAFT MAINTENANCE ACTIVITIES

One of the first P2 Model Shop Reports published concerned flightline maintenance activities, and served as the baseline for subsequent Model Shop Reports published by HQ AFCEE/EQ. It was noted that many of the opportunities contained within the Flightline Maintenance P2 Model Shop Report have recently become outdated in the face of significant advances in P2 technologies, and that an update was needed. To update the report HQ AFCEE/EQ teamed with Labat-Anderson Incorporated to conduct comprehensive P2OAs of aircraft maintenance activities.

The first change to the Flightline Maintenance Report was a name change, to include the "back shops" in the Component Repair and Equipment Maintenance Squadrons, to the Aircraft Maintenance Pollution Prevention Model Shop Report. Although many changes were made in the update, the purpose of this report remained the same: to provide a basic guide for identifying pollution prevention opportunities that are applicable to aircraft maintenance shops, thereby reducing the time and money required to complete future pollution prevention opportunity assessments.

The updated report contains detailed shop process descriptions, a list of the materials used and wastes generated by each process, and process diagrams. Ten detailed pollution prevention opportunities have been developed, and consist of a description, a technical analysis, a listing of advantages and disadvantages, and a detailed cost analysis. These opportunities include: absorbent pad wringers, automatic paint gun washers, digital imaging, engine oil analysis, fluid servicing carts, paint proportioning systems, parts washer alternatives, rechargeable flashlights/batteries, solvent tank filtration, and use of paint markers.

Ten management practices are also included in the report that require little or no capital investment; however, cost and time savings can be realized with their implementation. The management practices included are: characterize HW streams, closed loop oil management, fully utilize decal machines, hazardous material control, maximize JP-8 reuse, maximize use of existing P2 equipment, rag control, rag laundering contracts, utilize recycled antifreeze, and verify TO required HM usage.

Finally, good ideas and opportunities that were not fully analyzed are included in the report. Decisions on their implementation require additional investigative support that is beyond the scope of the model shop update. Installations are encouraged to review these opportunities to see if they can be realized as part of their P2 program and include: non-chromate primers; PMB recycling; solvent use with spray bottles; use of leading edge tape; and use of vacuum sanders.

Copies of the report may be obtained by calling PRO-ACT at DSN 240-4215 or (800) 233-4356, or on the HQ AFCEE/EQ web site at http://www.hqafcee.brooks.af.mil/eq/ (EQ Products Area).

For further information regarding this article, please contact Major Chris Taylor or Laura Maxwell, HQ AFCEE/EQ at DSN 240-4218.

Source: 4th Annual Joint Services, Pollution Prevention/Hazardous Waste Management Conference & Exhibition Proceedings, San Antonio, TX, Dec. 1999. ◆

INTERNET-BASED SHOP LEVEL POLLUTION PREVENTION TRAINING

HQ AETC/LG-EM and HQ AFCEE/EQ have prepared a shop-level pollution prevention training course that is delivered over the Internet. AETC and AFCEE worked with HQ USAF/ILEV and other Air Force MAJCOMs to prepare course materials that provide shop-level personnel with a basic awareness of pollution prevention through an interactive web-based format. The result is a training course that gives shop-level personnel important information without the time or expense of a traditional training format.

The use of a web-based distance learning approach provides many advantages over conventional training. Students complete the web-based course materials at their convenience. AFCEE divided the course content into individual lessons so that students may complete them over several sessions. The course software retains the student's registration information and the number of lessons completed. Distance-based learning greatly reduces the cost of delivery and does not require a minimum number of students. The web-based approach allows the Air Force to update the course content quickly and easily.

Students receive the training using a web browser. The Internet-based course uses the idea of a "virtual campus" to provide students with an interactive interface for receiving the training. The student registers, completes lessons, receives supplemental information, and asks questions to instructors using e-mail. Upon completing the course, the student receives a "virtual certificate". AETC supports the training through definition of

requirements and providing answers to student questions on technical matters. AFCEE supports the training course through maintenance of course materials and coordinating periodic updates to course content.

The course consists of six lessons, designed to take between fifteen and thirty minutes to complete. The first lesson presents information on the definition of pollution prevention and provides examples. The second lesson answers the question "Why is pollution prevention important?". The third lesson introduces the participants in the Air force pollution prevention program and their roles. Lesson four is an introduction to the concepts used in coming up with pollution prevention opportunities. The fifth lesson gives information on how an installation selects pollution prevention opportunities for implementation. The final lesson discusses the steps that can be taken to help facilitate change at the shop level.

The course materials provide students with an interactive learning environment. Using course materials originally developed by AETC, the group prepared content that gives students specific information on pollution prevention based on the shop in which the student works. The course provides hyperlinks to environmental regulations, relevant Air force forms, and sources of technical information. The course provides students with an introduction to pollution prevention, but the use of a web-based format allows students to receive more detailed instruction than could be delivered using traditional instructional techniques.

For further information regarding this article, please contact Mary Lou Slows, HQAFCEE/EQP at (210) 536-4667, Richard Freeman, HQ AETC/ILG-EM at (210) 652-6277, or Gary Chiles, SAIC at (713) 668-7549.

Source: 4th Annual Joint Services, Pollution Prevention/Hazardous Waste Management Conference & Exhibition Proceedings, San Antonio, TX, Dec. 1999 ◆

WATER TREATMENT SUCCESS UTILIZING THE MART EQ-1

The Mart EQ-1 has proved to be superior over the current system to treat wastewater generated by aqueous parts washers. Through the use of an encapsulating powder, contaminants are removed or reduced from the wastewater.

Wastewater from the parts washer is pumped into the EQ-1's upper tank and mixed with the encapsulating powder for approximately five to eight minutes. The treated water is then gravity fed through a 30 micron filter paper which captures the encapsulated sludge and allows the clarified water to fall into the lower storage tank. The clarified water is returned to the parts washer to be used over and over. The encapsulated sludge is rolled up in the filter paper and allowed to drain awaiting characterization and disposal.

Advantages such as waste reduction, direct savings to the shop by retaining approximately 80% of its soap and the elimination of skimmers on the parts washers were realized. There was a huge timesaving over manual cleanout of the parts washers. The elimination of the hazardous waste has meant the reduction of the Base's long term liability for that waste, as well as eliminating the paperwork, storage, labeling and disposal costs. The yearly cost of cleanout and disposal under the past practices would have been approximately $6,000.00. The cost to treat the same volume of wastewater utilizing the Mart EQ-1 was approximately $600.00. The return on an investment of $7,000.00 to purchase the EQ-1, would be approximately 14 months.

The users were skeptical at first, but after demonstration of the ease of operation of the unit, the elimination of their personal exposure to hazardous waste, and the time they gained to perform other duties added to their immediate acceptance of the unit.

For further information regarding this article, please contact Glenn Golson, Whiteman AFB at DSN 975-6265 or commercial (660) 687-6265.

Source: 4th Annual Joint Services, Pollution Prevention/Hazardous Waste Management Conference & Exhibition Proceedings, San Antonio, TX, Dec. 1999 ◆

THE PROPULSION ENVIRONMENTAL GROUP (PEWG) HOSTS WINTER MEETING

The Propulsion Environmental Working Group (PEWG) hosted its Winter 2000 Meeting in Annapolis, Maryland from 31 January through 2 February 2000. The purpose of these semi-annual meetings is to address common environmental, safety, and health problems affecting gas turbine engine propulsion systems, and to resolve those problems confronting both DoD depots and original equipment manufacturers (OEMs).

Mr. Gary Vest, Principal Assistant Deputy Undersecretary of Defense for Environmental Security, DUSD (ES), was the keynote speaker for the meeting. Mr. Vest elaborated on the serious challenge of international pollution issues that have implications across national boundaries. A new NATO initiative to address different pollution standards and national laws/regulations that exist in the various NATO countries was also presented at the meeting.

Details related to two new project starts, Electrospark Deposition Application in Gas Turbine Engine (GTE) Repair and Overhaul and Qualifying Environmentally Acceptable Alternative for PD-680 (Type I, II, and III) for GTEs, also discussed at the meeting, are summarized below.

Electrospark Deposition Application in Gas Turbine Engine (GTE) Repair and Overhaul:

This project will evaluate and qualify Electrospark Deposition (ESD) of coatings onto GTE components. ESD is a microwelding operation that uses short-duration high-current electrical pulses to deposit electrode material to a metallic substrate, using about two-thirds less current. The coating is fused (true metallurgical bond) to substrate. This process can be used to coat any electrically conductive material. It has been used extensively by the Department of Energy in nuclear power generating facilities. ESD coatings show practically no wear in contact stress applications. ESD can be used for any coating for which a consumable electrode can be made. Applications of interest in GTE repair and overhaul operations include platinum preplacement prior to diffusion coating, hard surfacing of blade tips and notches, repair of diffusion coating, buildup and repair of worn or undersize parts, preplacement of braze, corrosion and erosion protection, and repair of casting defects because of low heat.

The PEWG will collaborate with U.S. and Canadian military and industry engine repair activities and other teams working pollution prevention efforts. It will complement the effort being accomplished to replace chrome using High Velocity Oxygen Fuel (HVOF) Thermal Spray Coating.

Qualifying Environmentally Acceptable Alternative for PD-680 (Type I, II, and III) for GTEs:

This project will formally qualify alternatives to the PD-680 series of solvent cleaners for use in GTE maintenance, manufacture, and rework operations. This project will identify, test, and qualify depot-preferred alternatives (DPA) or revised DPAs. Alternatives, reformulations, changes in procedures, and technical order requirements will be investigated. The project will deliver a joint test protocol (JTP), potential alternatives report (PAR), and joint test report (JTR). Recommendations in alternative chemicals/processes for solvent use will be provided to the government monitor for review and approval. Master change pages for technical orders will be delivered to the government.

For additional information regarding these new project starts or the PEWG meeting, please contact Mr. Frank Ivancic at DSN 785-0444 ext. 3185, or Mr. Bob Bondaruk, at (937) 431-1900.

Source: Jim , ITB Farrar Inc.◆

CUSTOMER SERVICE AVENUES EXPAND AT THE DEFENSE SUPPLY CENTER RICHMOND (DSCR)

Customer Account Tracking System (WebCATS)

As the primary DLA Inventory Control Point (ICP) for air and aviation weapon systems, the Defense Supply Center Richmond (DSCR) strives to keep abreast of commercial business practices to provide leading edge customer service support to its customers. A combination of web technology, automated telephone systems, and traditional communication mediums provide a variety of customer service avenues tailored to the capabilities of military units in the field.

The web-based Customer Account Tracking System (WebCATS), developed and managed by DSCR, has gained tremendous popularity since its initial fielding in 1998. WebCATS is an automated logistics tool which offers the most current information available on a variety of supply information such as requisition status, shipping information, stock on hand, latest contract shipments, and weapon systems data.

Customers with Internet access can use WebCATS to view the same information our Inventory Managers, Buyers, and Weapon Systems Support Personnel use everyday. This reduces the amount of time required in obtaining this information from other sources. For our customers with Internet capability, WebCATS is the recommended tool for accessing DLA logistics information.

The WebCATS can be accessed through the World Wide Web via the DSCR home page at http://www.dscr.dla.mil. WebCATS is listed as a frequently visited site on the main page, and also as an option under "Customer Information". For obvious security reasons, a password is required and instructions for obtaining one are included on the WebCATS homepage.

Once inside the application, several data views are available: By weapon system, National Stock Number (NSN), and requisition number. Data from S9G (DSCR Richmond), S9I (DSCP Philadelphia), and S9C/S9E (DSCC Columbus) are conveniently consolidated into single point and click queries. Logistics information is also available for N32/N35 (Naval Inventory Control Point).

Users no longer need to access individual ICP systems to obtain the latest status. Navigation through the screens is user friendly, and a user's manual is available on-line. A link to our IT Help Desk is also available for customers experiencing technical difficulties.

The NSN inquiry contains detailed information such as stock on hand, backorder status, contract data, due-in data, requisition information, and item notes (item manager notes for Richmond items are also available under the SIMI option for the other ICPs). The requisition inquiry provides MILSTRIP data, NSN data, supply status codes, and links to the depot DSS system for shipment tracking, as well as commercial carrier sites. The Order Placement option allows customers to submit on-line requisitions directly to our Customer Call Center for immediate entry.

Weapon Systems inquiries include the Weapon System Designator Code (WSDC) inquiry, the Supportability Analysis inquiry, Special Program Requirements by DoDAAC, and the Weapon System Information inquiry. The WSDC inquiry provides the program manager and location of the weapon system, NSN counts of the items included, and backorder summaries. The Supportability Analysis inquiry is organized by special project type/service and lists the special project title and start date sorted by the WSDC. The Special Program Requirements (SPR) link provides detailed information related to Service forecast submissions by DoDAAC and NSN. The Weapon System Information inquiry is currently under construction and will provide an active calendar of events, trip reports, metrics, and POC lists.

Enhancements are implemented on a continuing basis to meet ever-changing customer needs. Your comments are welcomed and should be submitted via email to our Systems Administrator at tfisher@dscr.dla.mil.

Customer Call Center

Obviously there are times when automated means of information and services delivery do not fit your immediate needs. Communicating with Supply Center personnel and getting results on daily supply needs has never been easier. Our Customer Call Center stands ready to serve!

We promote our Customer Call Center as the main entry point for customer telephone inquiries. The DSCR Customer Call Center offers assistance on a wide variety of logistics issues such as submission of requisitions, expediting urgent requirements, shipment status, stock availability, and NSN information. This allows our item managers to focus on their core competency of managing their assigned items of supply. Our Call Center agents provide outstanding customer service and are usually able to answer the customer's question without transfer to another person. Agents log each call in a Support Magic client database so that customer demographics/trends can be analyzed to identify improvements to existing programs.

Our current Customer Call Center has evolved over the last few years, and today enjoys a high level of customer service, as measured by both qualitative and quantitative measurements. During 1999, customers experienced an average service level of 81 percent (percentage of calls answered within 45 seconds) with an average speed to answer of 24 seconds. These customer service levels parallel commercial industry best practice standards.

Quality control processes have been employed to ensure our customers are receiving the most professional and courteous service possible. We use a call-monitoring program to randomly evaluate individual Call Center agents on their call handling ability. We then rate their performance against preset standards for courtesy, accuracy, and adherence to operating procedures. During 1999, our Call Center averaged 99 percent in the areas of courtesy and accuracy and 97 percent in following standard operating procedures.

Additionally, as a second qualitative assessment, we conduct quarterly customer surveys to determine overall satisfaction with our Call Center's services. Random calls are made to customers who contacted the Call Center the previous day. Customers are asked a set of questions about services rendered during their call. Last year, ninety percent of our customers reported our service as either excellent or good.

At Defense Supply Center Richmond, we continuously seek methods to improve customer service to military and civilian personnel worldwide by keeping abreast of emerging technology and benchmarking business practices in the customer service community. We encourage customer feedback and suggestions to improve support. Customer feedback can be submitted through the DSCR homepage, the Call Center, and our surveys.

Our goal is to retain and expand our customer base by providing the best in weapon systems support. Our Customer Call Center can be reached in many ways. By Telephone: DSN 695-4865, commercial (804) 279-4865, or toll free 1-877-DLA-CALL. Please press zero at the DESEX prompt to reach an agent.

This article was submitted by H.E. Rowland, Defense Supply Center, Richmond.◆

UPCOMING EVENTS

Date	Conference	Location	POC - Phone/Fax/E-mail/Website
26-30 Mar 2000	26th Environmental Symposium and Exhibition	Long Beach Convention Center, Long Beach, CA	Kira Migliore kmigliore@ndia.org
29-30 Mar 2000	HCAT Meeting	Cincinnati, OH	Bruce Sartwell Phone: (202) 767-0722
10-12 April 2000	Tenth ASTM Symposium on Environmental Toxicology and Risk Assessment	Toronto, Ontario, Canada	Phone: (519) 888-4567, ext. 3209 greenber@sciborg.uwaterloo.ca
25 April 2000	DoD Ergonomics Best Practices 2000 Conference	Uniformed Services University of the Health Sciences (USUHS) Auditorium	http://chppm-www.apgea.army.mil/trng/describe.crs/erg.htm
25 April 2000	Environmental Training Workshop for Weapon System Developers	Picatinny Arsenal, New Jersey	Donna Gorog Phone: (973) 724-4666 MaryAnn Kisto Phone: (973) 724-3279
18-22 Jun 2000	Air and Waste Management Association's 93rd Annual Meeting and Exposition	Salt Lake City, UT	Phone: (412) 232-3444 FAX: (412) 232-3450 http://www.awma.org
23-27 Jun 2000	Defense System Acquisition Management	San Diego, CA	http://www.ndia.org
25-27 Jul 2000	AFMC Center Working Group Meeting	Hill AFB Ogden, UT	Frank Berger Phone: (937) 257-3498 Lori Luburgh Phone: (937) 257-7352
1-3 Aug 2000	Navy P2 Conference	The Ritz Carlton Pentagon City, Washington, DC	http://206.5.146.100/n45
11-15 Aug 2000	18th International System Safety Conference	Radisson Plaza Hotel, Fort Worth, TX	Myron Krueger Phone: (817) 763-3306 myron.d.krueger@LMCO.com
15-17 Aug 2000	PEWG Meeting	Rolls-Royce Indianapolis, IN	Bob Bondaruk Phone: (937) 431-1900
23-26 Oct 2000	Systems Engineering & Supportability Conference	San Diego, CA	ddewitt@ndia.org